Operating Instructions for SIGMA Plate Heat Exchangers

API Schmidt-Bretten

Content

1. General Remarks

2. Construction of Plate Heat Exchangers

2.1 Frames
2.2 Connections
2.3 Plates
2.4 Gaskets
2.5 Accessories

3. Installation

3.1 Unpacking the Plate Heat Exchanger
3.2 Assembly of the Plate Heat Exchanger
3.3 Connecting of the Unit

4. Start-up and Shutdown

4.1 Starting up the Plate Heat Exchanger
4.2 Shutdown of the Plate Heat Exchanger
4.3 Stop periods

5. Operation

6. Servicing and Maintenance

6.1 Opening the Plate Heat Exchanger
6.2 Cleaning the Plates
6.3 Testing the Heat Exchanger Plates
6.4 Testing the Gaskets
6.5 Gasket Change
6.6 Assemblage of the Unit
6.7 Reconditioning / Enlargement / Repairing
6.8 Plate Diagram

7. Recognizing and Correcting Mistakes

7.1 List of Questions
7.2 Leakage
7.3 Product Mixture
7.4 Heat Transfer Performance Problems
7.5 Pressure-loss Problems

8. Spare Parts

9. Tools

10. Documentation

11. Addresses

1. General Remarks

API Schmidt-Bretten GmbH & Co. KG is in the business of solving thermal problems since 1879, and is producing the SIGMA series of plate heat exchangers since well over six decades.

We produce a wide assortment of heat exchangers with gaskets for a broad range of heat exchange applications.

Although our SIGMA heat exchangers are still being utilized in their traditional area of application, that is the milk and beverage industry, our wide selection of units are employed in nearly all industrial areas.

The wide scope of possible applications ranges from lubricating oil coolers on ships, to refrigerant evaporators, to hot water preparators, all the way to fruit products pasteurizing units.

The wide variety of unit sizes, as well as of available plate structures, are the basis for API Schmidt-Bretten's optimum designed plate heat exchangers no matter for which application they are intended.

In the following text, you will find information concerning the assembly, the functioning, and the operating of a SIGMA plate heat exchanger.

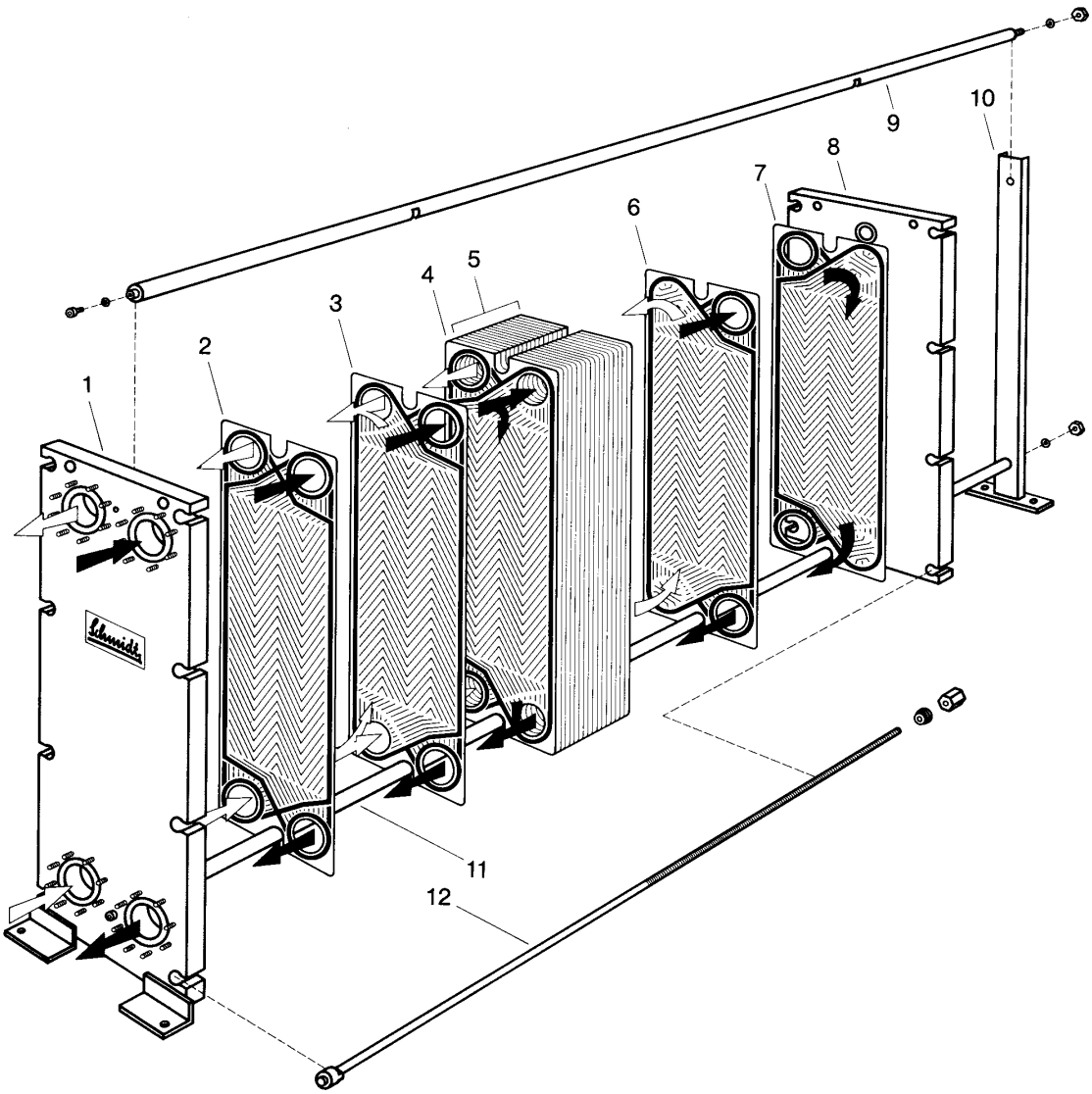
If you still have questions concerning our products after having read the information, one of our specialist will be happy to help you.

We wish you much success with the SIGMA plate heat exchangers.

Your API Schmidt-Bretten - Team

2. Assembly of Dismantled Units

A plate heat exchanger, as seen below, is a pressure vessel that is composed of pressure parts such as the lateral tie rods and the frame plates.



1 Fixed Frame Head w/ Flow Ports	5 Plate Pack	9 Upper carrying Bar
2 First Plate	6 Left-hand Flow Plate	10 End Support
3 Left Hand Flow Plate	7 Right-hand Flow Plate	11 Lower Carrying Bar
4 Right Hand Flow Plate	8 Movable Cover	12 Tie Rod w/ Locking Nut

Single corrugated heat exchanger plates are combined into a plate packet to form flow channels, which are enclosed with gaskets.

These flow channels make it possible for the liquids that enter and exit through the connecting holes consequently to undergo thermal treatment by conducting heat through the heat exchanger plates.

2.1 Frames

A variety of frames are available. Their differences consist in construction form, in the type of material used for their construction, as well as in their strength.

The dimensioning of the standard plate heat exchangers is based on the rules of the German “AD-Merkblätter”. The standard selection of materials refer to DIN.

The designation of the frames consists of the following information:

SIGMA 27 N B L

Line of products	Type	Construction Form	Pressure class	Construction Material
		N, S, T	A, B, C, D	L Lacquered steel N Solid stainless steel V Steel covered with stainless steel

Construction Forms

“N” “S” “T”

2.2 Connections

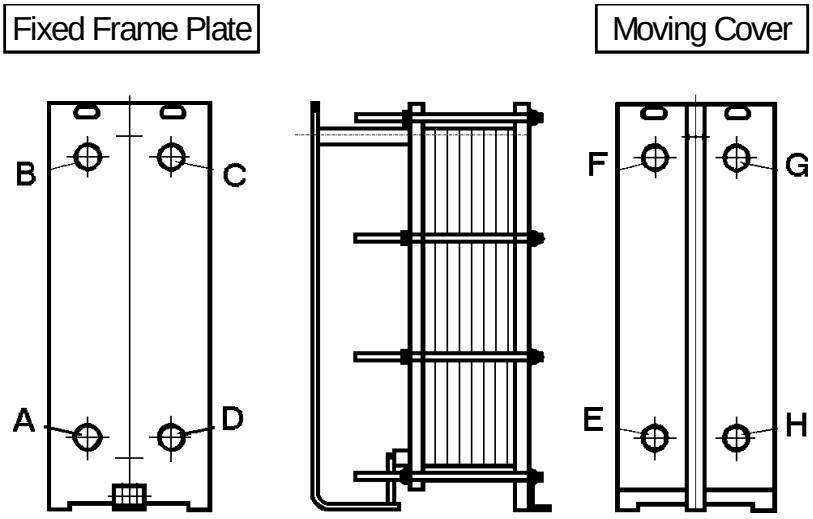
SIGMA plate heat exchangers come equipped with a range of different connection types according DIN-Standard.

The choice of corrosion-proof material used for the connections depends on the medium that is to undergo the thermal process. A higher alloyed and more resistant material is required for the connections and the lining, if a more aggressive medium is to be treated.

A cost-effective variation would be to employ the same material utilized in the plate gaskets for the lining of the connections.

Additional connections used for ventilation or draining usually have a smaller nominal width than the product connections.

The diagram below shows the letters attributed to the position of the connections.

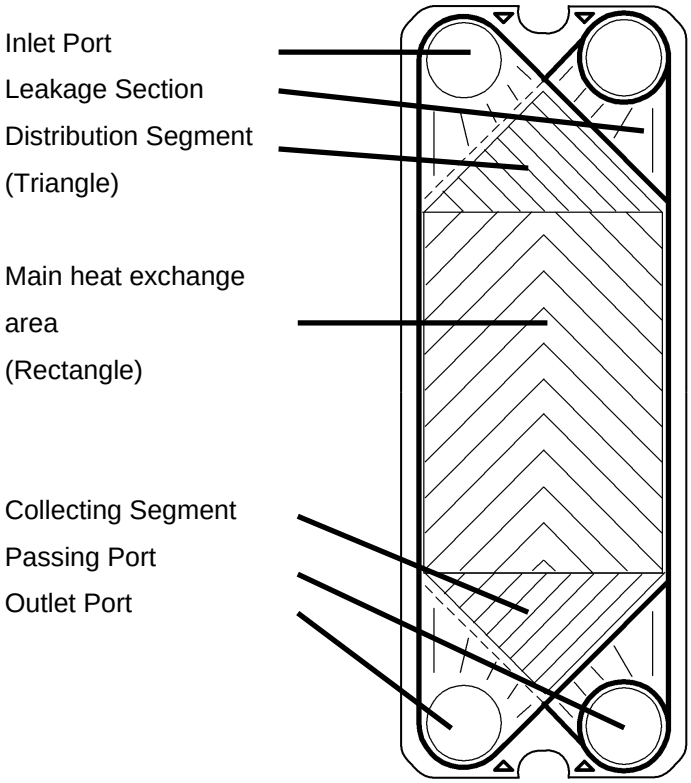


2.3 Plates

One of the main components of the heat exchanger is the plate package. The number of plates and the type of plate corrugation used in the heat exchanger unit depends on the type of thermal process that is to take place.

The flow path through the plate package also depends on the thermodynamic requirements of the plate heat exchanger.

All heat exchanger plates are in principle composed of a single plate segments.



The composition and the temperature of the media, which are to take part in the thermodynamic process, determine the type of materiel used for the manufacturing of the heat exchange plates.

As possible materials the following are used in general:

- Stainless Steel: AISI 304, AISI 316, AISI 316L, AISI 316TI, AISI 904L, SMO 254
- Nickel Alloys: 2.4066 (pure nickel), 2.4819 (Hastelloy C-276), 2.4858 (Incoloy), 2.4360 (Monel)
- Titanium / -alloys: 3.7025 (titanium Grade 1), 3.7225 (titanium-Pd)

The thickness of the plate material is depending on the plate type and the required pressure resistance. It ranges between 0.4 mm and 1.15 mm.

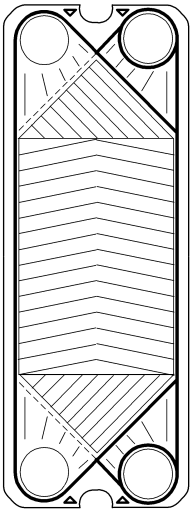
The flow-characteristics of the plate gaps are interlocked with the profile of the plate corrugation.

API Schmidt-Bretten disposes over a wide assortment of plates with varying corrugations. Each has its own specific hydraulic and thermodynamic properties, as well as in product distribution and cleaning behavior in relation to the product consistencies.

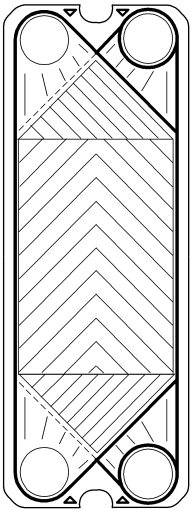
Plate packages can consist of plates with varying plate corrugation patterns. The following corrugation patterns are available for the optimizing of thermodynamic flow paths.

Each plate heat exchanger is optimized according to the specific use in mind. Consequently,

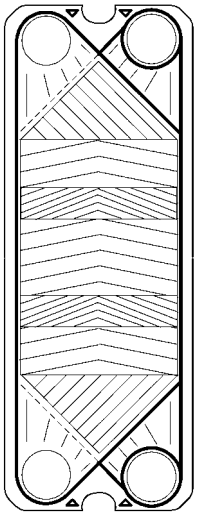
H-Corrugation



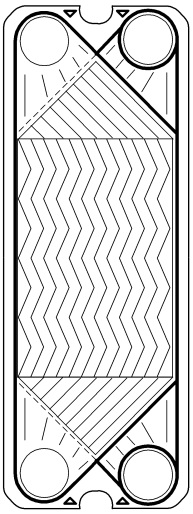
W- Corrugation



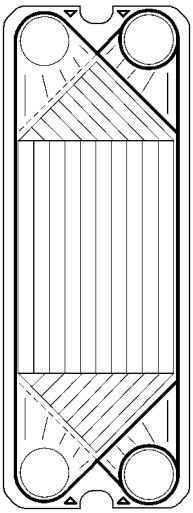
Y- Corrugation



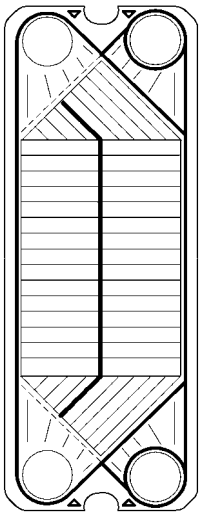
Z- Corrugation



V- Corrugation



F- Corrugation



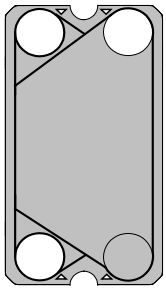
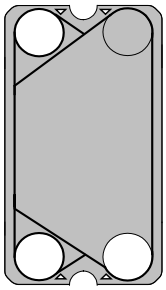
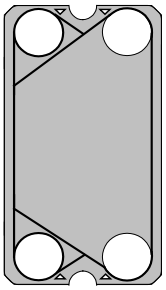
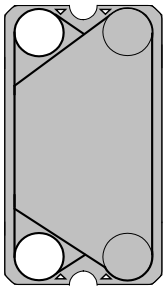
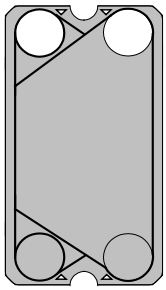
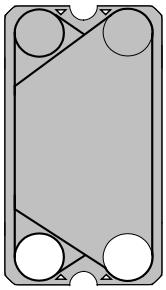
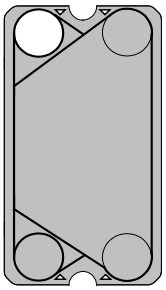
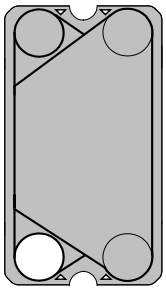
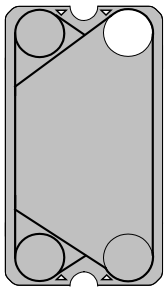
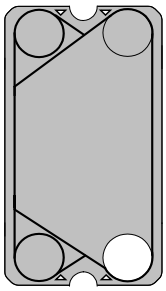
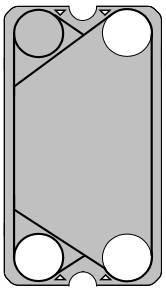
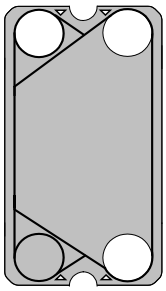
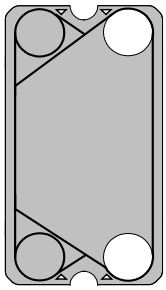
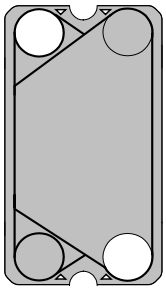
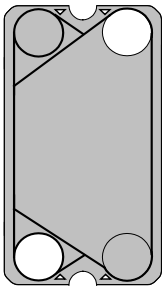
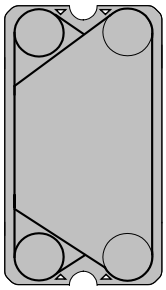
various heat exchanger units have different arrangements and flow paths through which the product is fed.

A parallel or serial arrangement can be achieved by opening or closing the outlet ports.

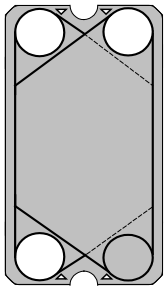
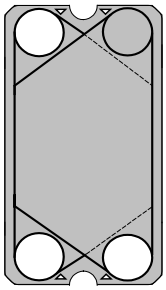
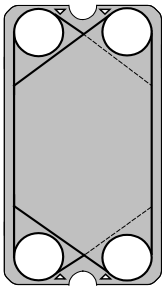
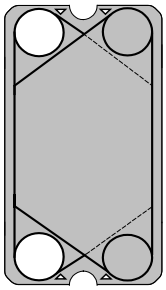
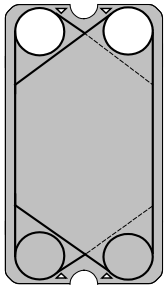
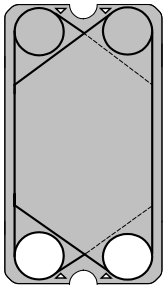
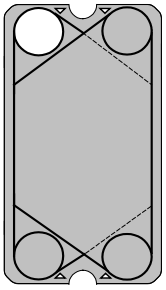
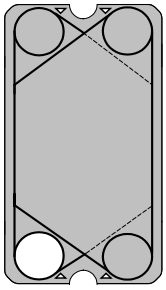
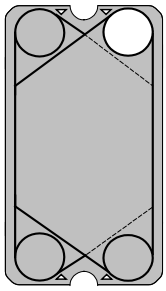
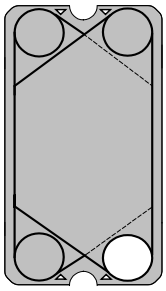
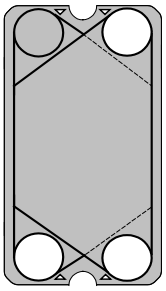
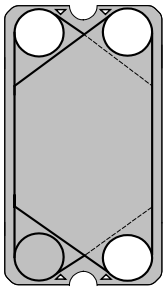
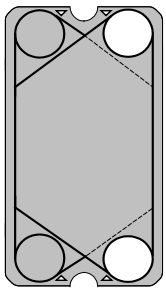
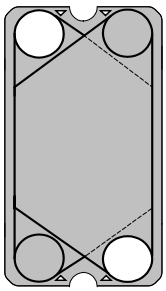
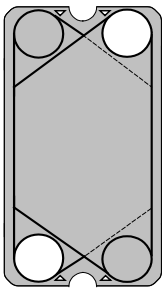
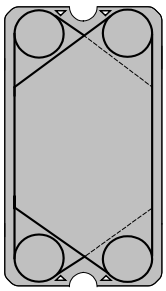
The plates, which do not have four open inlet / outlet ports, are called “turning plates”. For a clear identification of the turning plates, a nomenclature consisting of letters, which are attributed to the various inlet and outlet ports, is used (refer chapter 2.2).

When looking at a heat exchanger plate, with the plate side which holds the gasket facing towards you, if the inlet and outlet port are situated on the left side then this is a left plate. When the outlet ports are positioned on the right side this indicates that it is a right plate.

Turning Plates

AR  BL	BR  AL	CR  CL	DR  DL
ER  FL	FR  EL	GR  HL	HR  GL
IR  JL	JR  IL	KR  LL	LR  KL
MR  ML	NR  OL	OR  NL	PR  PL

Start Plates

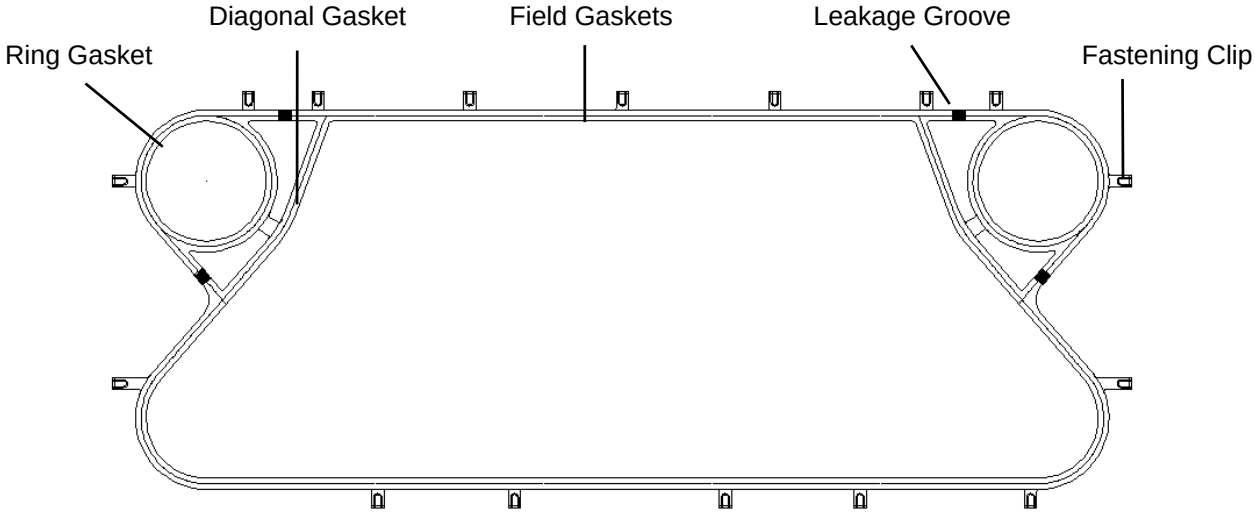
AAR/EAR  ABL/EBL	ABR/EBR  AAL/EAL	ACR/ECR  ACL/ECL	ADR/EDR  ADL/EDL
AER/EER  AFL/EFL	AFR/EFR  AEL/EEL	AGR/EGR  AHL/EHL	AHR/EHR  AGL/EGL
AIR/EIR  AJL/EJL	AJR/EJR  AIL/EIL	AKR/EKR  ALL/ELL	ALR/ELR  AKL/EKL
AMR/EMR  AML/EML	ANR/ENR  AOL/EOL	AOR/EOR  ANL/ENL	APR/EPR  APL/EPL

2.4 Gaskets

Every heat exchanger plate of a gasketed plate heat exchanger is fitted with a complete gasket.

The gaskets keep the fluids that flow through the heat exchanger separated from each other and contained within the unit.

Each heat exchanger plate is fitted with two ring- and two field gaskets. The only exceptions are the plates, which face the frame heads.



Within the gasket is a leakage area with a leakage groove. As soon as diagonal- or ring gasket is defective this leakage groove makes the leak visible on the outside.

The functioning of these leakage grooves is guaranteed as long as the gasket has not lost its original shape due to thermal influences, or that the leakage grooves have become congested due to the impurities contained in the product, or that the plate packet was not tightened properly below the given final clamping dimension.

In general, there are two ways of fixing the gaskets to the heat exchanger plates:

- The fixing of a gasket to a plate by means of adhesives:

  A special adhesive is placed as a complete layer into the heat exchanger plates' gasket groove. After the gasket has been fitted in and the adhesive has hardened, the gaskets and plates are joined permanently.

  This method of fixing the gasket to the plate is especially advantageous for systems, which have to be opened for cleaning on a regular basis.

  The gaskets loose their effectiveness with time and then have to be exchanged. When gaskets are changed, they have to be removed carefully and new ones have to be fixed to the plates.

  Depending on the gasket material and quality, this procedure may be performed directly on site.

  It is however highly recommended that the plates be returned to the manufacturer, who will then perform the gasket change.

- Adhesive free gasket fixing system

  When using an adhesive free gasket fixing system, in contrast to the adhesive fixing system, the gasket is held in place through a number of fixing points. The fixing points are determined by the size of the heat exchanger plate.

  The fixing of the gasket to the plate is achieved through lateral mounting clips, which are clamped into the recess on the plate edge.

  The changing of the gasket is easy and can be performed on site.

When choosing the material for the gaskets, the same criteria as for the choice of heat exchanger plate material has to be kept in mind. The choice of material depends on the type of medium to be treated as well as the temperature upon entering and exiting the heat exchanger unit.

The following are the standard elastomer gasket materials that are available:

NBR
EPDM
FPM
CSM
Chloroprene
Silicone

Apart from these, for certain plate types it is possible to employ compressed-fiber materials.

The service life of a plate heat exchanger gasket depends on a variety of factors.

The following factors have an influence on the service life of the gasket:

- the operation of the heat exchanger

  (continuous or discontinuous operation)
- the maximum operation pressure
- the maximum or minimum operation temperature
- temperature- or pressure load changes
- the composition of the products which undergo the thermal treatment, their additives as well as the mediums used during the cleaning processes
- mechanical stress due to irregular or to tightly adjusted frames

2.5 Accessories

2.5.1 Intermediate Frames and Intermediate Plates

For a range of applications several sections with varying thermodynamic functions can be installed within a plate heat exchanger, as is the case within a food stuff pasteurizer with a cooling, a heating, and a heat recovery section.

Nevertheless, each section requires its own inlet and outlet ports. Intermediate frames which are built-in to serve as separation between two adjacent sections can be equipped with the appropriate connections for the functioning of that section.

In contrast, intermediate plates without connections merely serve as separation between two adjacent sections.

2.5.2 Protection Cover and Insulation

Heat exchangers with operating temperatures of over 50 °C or under –10°C should be fitted with a protection cover in order to avoid any injuries through contact.

Direct contact with the heat source can be avoided through the mounting of protection covers. These protection covers, which are made out of thin stainless steel, are fitted over the plate pack.

Another safety feature of the protection cover is that it also serves as splash guard against the mediums contained within the heat exchanger in case of a gasket leak due to aging of the gasket.

Compared to the large internal heat exchange surface, the exterior of the heat exchangers is relatively small. Although the exterior surface is not very extensive, for some applications it would be advantageous to install an isolation barrier.

The plate heat exchange may be insulated using one of two methods. The unit can either be completely insulated using a solid insulation which encases the whole unit and which can be removed in one piece, or only the plate pack may be insulated so that any heat losses towards the outside are avoided. In this case, the plate pack is covered with a protection cover, which includes a layer of insulation on the inside.

It is the responsibility of the operator to ensure that the proper safety precautions are taken so that no injuries to persons, or damage to the environment occur in case of heat exchanger malfunction or damage leading to leakage.

2.5.3 Safety Precautions Against Outer Influences

In general, it is not possible to protect a heat exchanger from outside influences such as heat or other atmospheric influences.

It is however necessary to foresee certain safety measures. In case of a fire the heat exchanger unit must be depressurized through a built in automatic control system in order to avoid an increased risk of damage caused by the pressurized mediums contained within the unit.

As a preventive measure against possible damage from aggressive substances contained in the surrounding area, all parts of the heat exchange unit, such as the pressure frames, the heat exchange plates, and the gaskets must be pre-treated accordingly.

When choosing the location of the heat exchanger unit it should be kept in mind that, UV or other rays can have a negative effect on the gaskets and thus shortening the service life of the seal.

3. Installation

3.1 Unpacking of the Heat Exchanger Unit

Units, for which the net weight is to found in the technical documentation, usually are delivered lying flat on a pallet.

When transporting these pallets with a fork lift it is important to verify that the supporting surface of the forks is long enough to support the pallet in order to avoid possible braking of the pallet and damage the heat exchanger unit.

The unloading of the unit may only be done with the proper machinery such as flat lifting slings, which can be fastened to the securely bolted frame and/or to the loops, which are foreseen especially for the transport of the unit. Under no circumstances are the connection tubes or intermediate frames to be used in the unloading and transporting of the unit.

All lifting loops must be used during the transport in order to avoid a warping of the unit caused by improper transport.

3.2 Mounting of the Plate Heat Exchanger

First of all the unit has to be aligned in the proper assembly order.

Then the floor supports for the frame and the end support must be set up.

For units that have an additional supporting leg on the lower-carrying bar, the supporting leg must be adjusted so that it has a proper contact with the floor.

Enough space should be foreseen around the heat exchanger unit. Depending on the model about 1,5 m of space is needed, so that during the servicing of the unit by our erecting engineers, plates can be removed from the plate pack and spanners can be used without any spatial restrictions.

Tubular connections situated on the movable pressure plates as well as on the intermediate-frames must be easily accessible for servicing.

Under certain circumstances, it may not be possible to deliver the heat exchanger as an assembled unit. Even if the unit is delivered in a disassembled state, before it left the production plant it was tested for quality of build and underwent all the required pressure tests. However, after the unit is assembled within your facilities before it is put into operation it must undergo another pressure test. All the required information is to be found in the technical documentation.

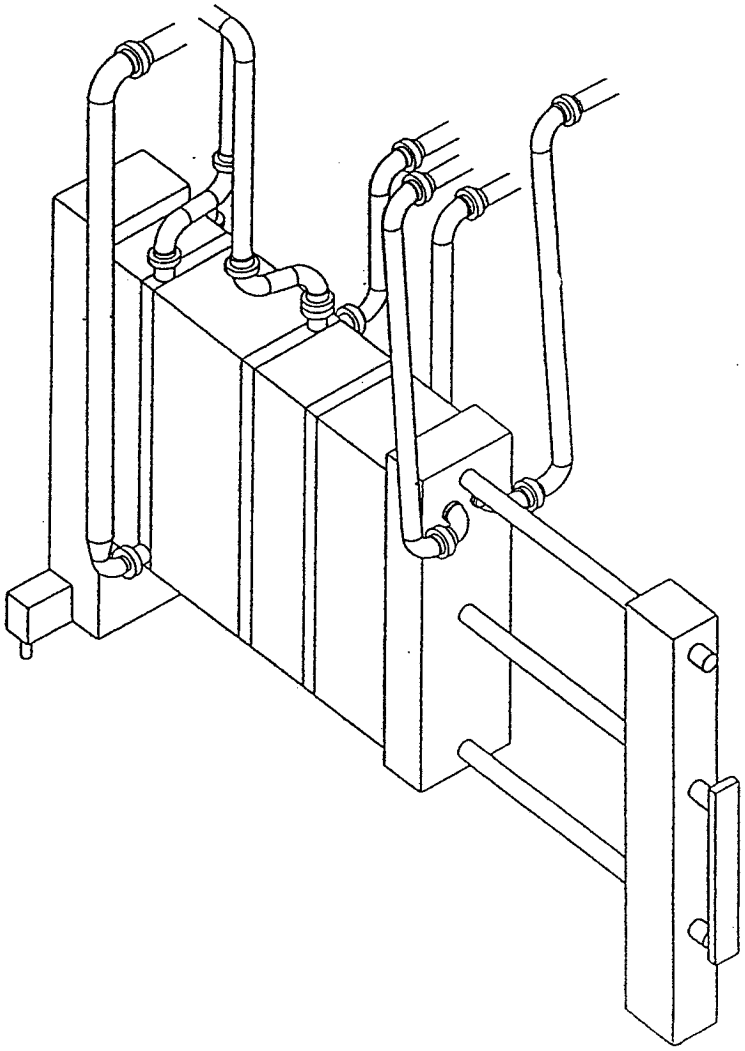
3.3 Connecting of the Unit

The connecting tubes must be installed without any stress and tensions.

The connections leading through the movable cover or through one of the intermediate frames must remain movable within the theoretic maximum and minimum dimensions.

If pressure would be absorbed by the tubes during a re-tightening of the plate pack a complete seal of the unit could no longer be guaranteed.

In order to avoid any stresses on the tubes, expansion joints such as pipe swing bends, made up of several movable tube bends can be incorporated into the pipeline.



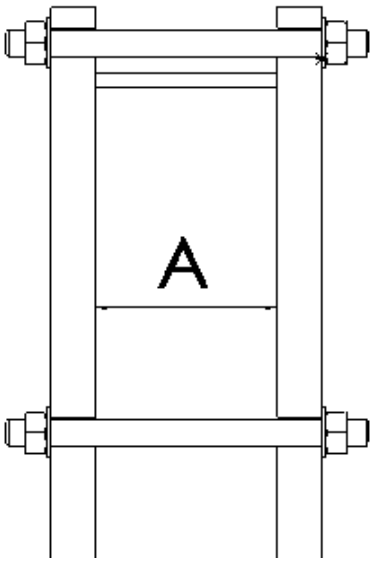
4. Start Up and Shutdown

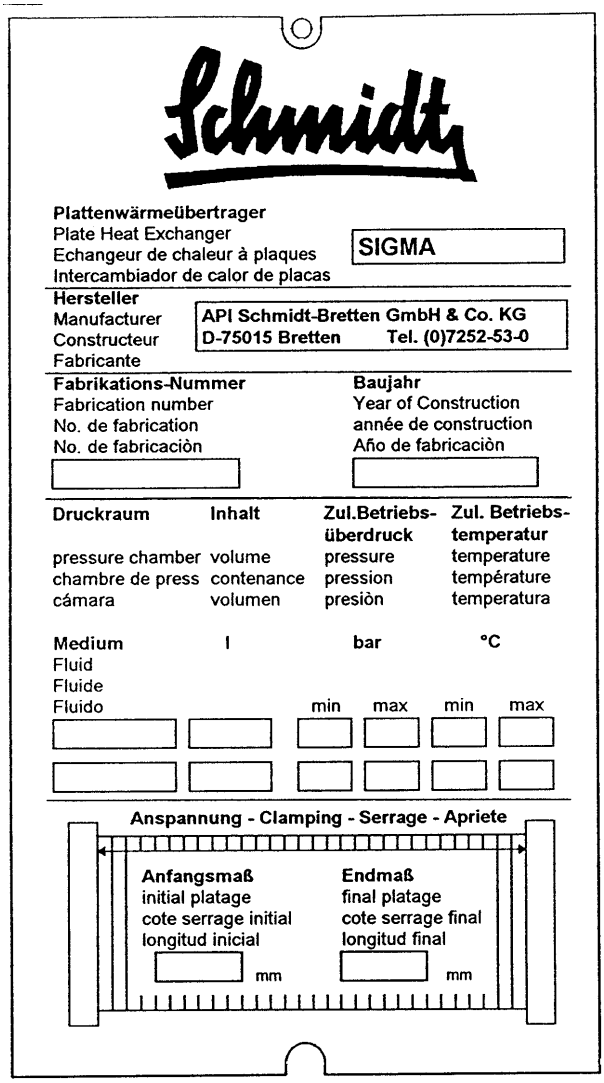
Before starting up a plate heat exchanger, make sure that the admissible pressures and temperatures indicated on the name plate are not exceeded. Safety measures in case of exceeding temperature and pressure are to be observed.

The compatibility of the media to be treated with the materials used for the construction of the plate heat exchanger is to be checked before the start up of the unit.

It may be possible that the tie rods become loose during transportation of the unit in a depressurized state, or after the first few days of operation, simple retighten the tie rods.

Before restarting the unit it should be checked that the measurements regarding size and uniformity of all tightening bolts correspond to the dimension A (see drawing).





To avoid pressure shocks during start-up and shutdown of a heat exchanger unit appropriate components should be built into the unit or the technical operation conditions should be adjusted so that a minimum of pressure shocks occurs.

After prolonged operating periods with on and off phases it is possible, especially when using compressed fiber gaskets, that leakage occurs when the heat exchange unit is cold. These leaks get smaller with ever increasing temperatures. They are a part of the natural setting phenomenon of the gaskets.

4.1 Starting up the Plate Heat Exchanger

To start-up, the plate heat exchanger please follow the following instructions:

1. Position of the valves:
   - Close the valves in the feeding pipe (if no volumetric pump is installed).
   - Open the valves in return pass (if applicable).
2. Open the vent valves (if applicable).
3. Check positioning of the valves, then switch on the pump.
4. Open the inlet slowly in order to avoid pressure shocks.
5. When all the air has been evacuated from the plate heat exchanger, close the vent valves.
6. Before opening the inlet completely, check if all the air has been evacuated from the heat exchange unit.

Which product side is to be started-up first depends on the type of system used, as well as from the thermodynamic process that is to take place. As far as it is possible, the following rules should be followed:

- It is recommended to start-up the product side, which will contain the medium with the lower process temperature and pressure.
- By cold pressure cycles, if the temperature of the cooling medium is below the freezing point, then the medium to be treated should be fed into the heat exchange unit first in order to avoid a freezing up of the unit.
- It is also important to note that the sequence of the product feed should be chosen so that when the product enters the plate heat exchanger no uncontrollable evaporation occurs.
- Generally: Volumetric pumps have to start up softly.

4.2 Shutdown of the Plate Heat Exchanger

When shutting down the plate heat exchanger, in order to avoid any pressure shocks, please follow these instructions:

1. Slowly close the valve of the product feed pipe.
2. Turn off the pump only after the valves of the feeding pipe are completely closed.
3. Steps 1. and 2. are to be repeated for the second product side.
4. Close the valves for the return pass.

4.3 Stop Periods

Before a long operation pause, clean the plate heat exchanger thoroughly so that the risk of corrosion damage is minimized.

It is recommended that the tension is released within the plate heat exchanger and only to retighten the unit before it is to be put back into operation.

5. Operation

Each plate heat exchanger is designed and built for specific thermodynamic operations with processing, cleaning, and sterilization cycles taken into account.

Before the heat exchanger unit can be used for the processing of any media other than originally planed, all parts of the unit which come into contact with the medium, such as gaskets, heat exchange plates and connections, have to be tested for compatibility with the new medium.

The plate heat exchanger may only be put into operation after it has been verified that the unit is capable of processing the new medium.

It is the responsibility of the units owner to ascertain that upon feeding a new product into the unit no chemical or thermal reactions will occur due to reaction with previously treated fluids which remained in the unit.

If the possibility of such a reaction exists then the heat exchange unit must be completely drained before a new fluid is pumped in.

If during a thermal process the operating temperature, operating pressure or the flow rate of the product feed has to be changed, the adjustment should be done slowly and over longer span of time.

In general, a continuing operation cycle is best suited for a heat exchange unit.

If however the continuing operation of the heat exchange unit is not possible due the required thermal treatment conditions, precautions have to be foreseen in order to avoid rough switch over to a different thermal process function.

Often occurring pressure variations even in small amplitudes may have a negative effect on the service life of the gaskets.

If possible it should be avoided that a plate heat exchanger constantly undergoes extreme temperature variations, from being hot to completely cold, since this process speeds up the aging of the gaskets.

To minimize the stress and to extend the service life on the gaskets additional spring joint packages can be built into the tie rods.

Not only, the variations in operation conditions can damage the heat exchanger unit, but processes, which take place within other parts of the system. On- or off-switching of other components may cause pressure shocks that are carried all the way through the system to the heat exchanger unit.

In this case, the demands for the heat exchanger units' rigidity should be compared with the actual parameters given for the original function of the unit.

With a plate heat exchanger the risk exists that a plate cracks occurs. This problem may be caused through the deposit of corrosive materials on the heat exchanger plates or due to pressure variations that occur over longer operation periods.

In case of a plate crack the mixing of the products may occur.

If one of the products must be kept clean, and may not be contaminated by the other medium taking part in the thermodynamic process, possible contamination in case of a plate crack can be avoided by pumping this medium through the unit at a much higher pressure than the other fluid.

6. Servicing and Repair

Due the great number of heat exchange applications, it is not possible to set a standard time interval at which the unit must be serviced.

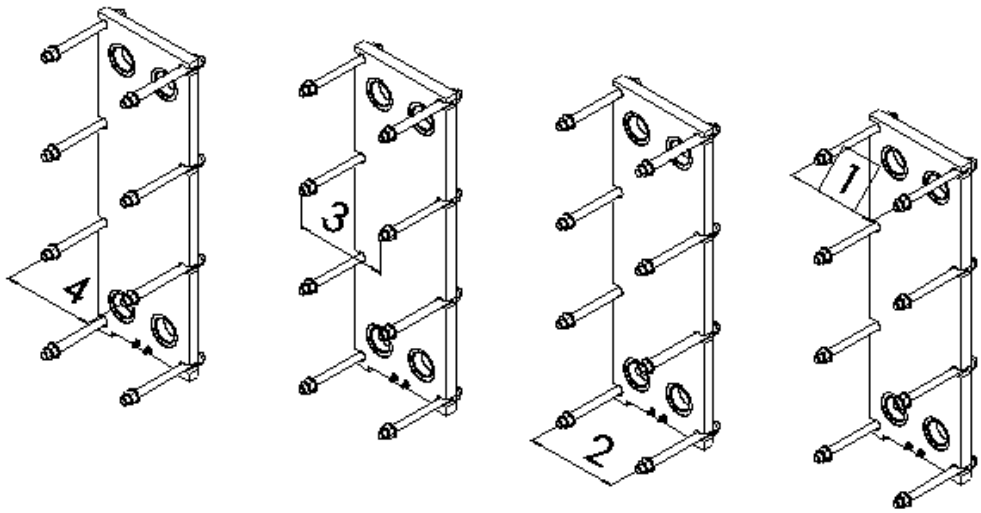
According to need, the following repairs and tune-ups have to be carried out:

- In case of leakage, the unit has to be retightened.
- If leaks persist after the unit has been retightened, other causes have to be investigated.
- If leaks can not be stopped because the unit has been tightened up to the final platage (see name plate), then the gaskets have to be changed.
- For units that have been in use since a longer period, not only the gasket at the leakage spots should be changed, but also the whole gasket system should be replaced.
- The tie rods as well as the contact surfaces between the lock nuts and centering plates has to be greased before being retightened.
- By reduced heat capacity or increased pressure loss, the heat exchanger plates have to be cleaned.

6.1 Opening the Heat Exchanger Unit

As already explained above, before opening the heat exchange unit it must be shut down and completely drained of its content.

Fluids that represent a health hazard to humans, and a threat to the environment, have to be carefully stored in the appropriate containers.



Tubes connected to the movable cover or to intermediate frames have to be dismantled.

So that the unit can later be returned to its original dimensions, the actual degree of platage should be measured and noted before opening the unit.

Please note that the heat exchanger unit may only be opened once it has been depressurized and cooled to a temperature of less than 40°C.

The tie rods should always be loosened towards the inside (see diagram).

While loosening the tie rods, it is important to verify that the movable cover does not reach an inclination of more than 10mm, as long as there is still strain on the tie rods.

6.2 Cleaning of the Plates

Different options exist for the cleaning of the heat exchanger plates:

6.2.1 Cleaning in Place (CIP)

When cleaning the unit with the heat exchanger plates in place (CIP) a cleaning solution takes the place of the product. For the best cleaning results, the cleaning solution should be pumped through the unit in the opposite direction as the usual product flow.

A higher flow rate of the cleaning solution ensures an even better cleaning result.

In case that the pressure pumps are not strong enough to further augment the flow rate during the cleaning cycle another option remains. Through the addition of compressed air, the turbulence of the cleaning solution within the unit is increased and better cleaning results are obtained.

The compatibility of the cleaning substance with the plates, connections and gasket materials as well as gasket adhesives must be tested before the cleaning of the unit occurs.

The exact cleaning procedure, regarding cleaning substance, volume of cleaning solution, as well as duration of the process, depends on the type of construction materials used in the heat exchanger unit as well as the type of deposits to be removed. We recommend that you take up contact with a cleaning agent manufacturer.

We recommend the following DIN 11 483 certified cleaning and disinfecting agents:

Cleaning and disinfecting agent	Concentration [wg.-%]	Contact time [h]	Temperature [°C]	Gasket Material
Alkaline cleaning agent with NaOH-base	up to 5	no limit	up to 90	NBR EPDM
Combination cleaning agent NaOH + Na-Hypochlorite	up to 5	1	up to 70	NBR EPDM
Acidic cleaning agent with Phosphoric acid base	up to 5	1	up to 90	NBR EPDM
Acidic cleaning agent with nitric acid Base	up to 2	0,5	up to 50	NBR EPDM
Acidic cleaning agent with citric acid base	up to 4	1	up to 40	NBR EPDM
Disinfecting agent with peracetic acid and / or hydrogen peroxide base	up to 1	up to 2	20	NBR EPDM
Hot water	-	no limit	120	NBR EPDM

6.2.2 Cleaning of the Plates in Disassembled Form

In the dismantled state, the heat exchanger plates can be cleaned with a steam jet.

Stainless steel or plastic brushes may be used for the scrubbing of the heat exchanger plates.

A chemical cleaning of the heat exchanger plates, in an acidic or in an alkaline bath, is possible for plates with non-adhesive gaskets as long as the gaskets are removed before the plates are placed into the bath.

The chemical resistance of the plates to the chemical cleaning agent should be checked before the plates are submerged into the bath, in order to avoid any possible damage to the heat exchanger plates.

For plates with adhesive-gaskets, the same precautions apply. It should be verified that the gaskets and the adhesive are compatible with the cleaning solution, what the maximum contact time is, as well as the maximum temperature tolerance.

After the cleaning process, it is important to remove any cleaning solution residues in order to avoid any possible corrosion, which may be caused by the solution. The unit should be rinsed out with plenty of water.

6.3 Inspecting the Heat Exchanger Plates

The ware of the heat exchanger plates can be checked visually, damages of the plates such as scratches, deformities or corrosion can be seen with the naked eye.

In order to detect any plate cracks one of the following procedures is to be followed:

One of the circuit paths is to be filled with a medium while the other circuit path is to remain depressurized.

If the medium filled circuit path shows a significant drop in pressure, and there are no leaks to be seen from the outside, then it is certain that there is a plate crack within the unit. It is recommended that this test be performed in all the units circuit paths.

To detect plate cracks in a depressurized state a dye penetration method is used. One side of the plates is sprayed with a red color, while the other side is impregnated with a white color sensitive developing agent.

If there are any cracks or holes present, which have penetrated through the heat exchanger plates the red color, through diffusion, will appear as a spot on the white side of the plate.

6.4 Inspecting the Gaskets

Through a visual inspection, deformities of the gasket, improper fit into the gasket groove or damage of the gasket or of the adhesive, are easily detected.

To test the functioning of the gaskets, a single sided circuit pressure test can be performed.

It is certain that the gaskets are functional, under the condition that the leakage grooves are not deformed or blocked with dirt, when no leakage is detected on the outside of the unit when using the single circuit pressure test.

A very minute, drop like leak can be fixed by simply re-tightening the unit, as long as the unit has not been tightened to its final platage, and the gaskets have not suffered any thermal, mechanical or age related damage.

If the leak is not corrected after re-tightening of the unit, the problem might have had some other reasons. The gaskets have to be inspected because they may have shifting out of place or be damaged.

6.5 Changing the Gaskets

Adhesive-free gaskets can be changed by simply opening the heat exchanger unit and without having to remove the plates.

It is important to check that there is no dirt on or under the gasket, as well as in the plates' gasket groove.

For heat exchanger plates with adhesive fixed gaskets the following procedure applies: (EPDM gaskets are an exception, it is recommended that plates with EPDM gaskets are sent back to the manufacturer who will perform the gasket change).

- Dismantling of the plates.
- Removal of the gasket either through the light application of a flame to the back of the gasket groove (annealing colors through the applied heat should be avoided) or through the submergence of the plate in a nitrogen liquid bath.
- The gasket groove must be cleaned, and all adhesive as well as gasket residues must be removed.
- Roughen the gasket groove through sand blasting or sandpaper.
- Apply the adhesive into the gasket groove with a paintbrush.
  (only original *API Schmidt-Bretten* – adhesive is to be used)
- Clean the gaskets with a lint free cloth, which was drenched in acetone.
- Place the gaskets into the gasket grooves.
- Place about 20 plates in between a wooden frame, which is then compressed with a parallel screw clamp.
- Let the adhesive dry for approximately 12 hours at room temperature.
- Remove any excess adhesive on the gasket surface.
- Reinstall the plates according to the plate diagram.

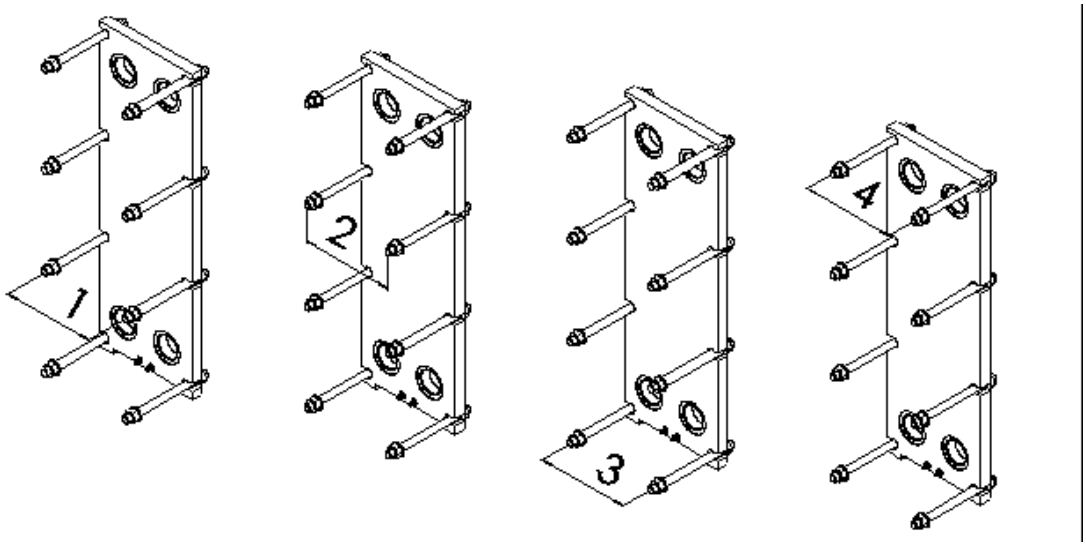
More detailed instructions are available from our head office upon request.

6.6 Assembly of the Heat Exchanger Unit

Plates have to be installed in the same layout as is shown in the instruction manual. It is important to check that each plates' corrugation pattern, connecting ports, orientation (every second plate is turned by 180°) and position within the plate pack is correct.

Only after all the plates have been properly installed can the heat exchanger unit be tightened.

The plate pack should be clamped evenly and the tie rods should be tightened crosswise in the opposite order as when un-tightening the unit.



Take care not to tilt the cover to one side or bend it at any stage (max. inclination 10 mm).

The plate heat exchanger should not be tightened more than necessary so that the service life of the gaskets is not reduced due to excessive pressure.

6.7 Modifications / Extensions / Repairing

One of the advantages of plate heat exchangers is that they can easily be modified to suit new production needs without greater proceedings.

However, ever time a plate heat exchanger is rebuilt its name plate has to be updated or exchanged, since the plate quantity and sequence, as well as the maximum clamping was altered.

If due to the reconditioning or enlarging of the unit the bottom carrying bar and/or the tie rods have to be exchanged, a special permission is to be obtained from the manufacturer since these parts are important pressure parts.

The same applies to welding work that needs to be performed on pressure parts. The welding work may only be performed through qualified specialists after having received the approval from the manufacturer.

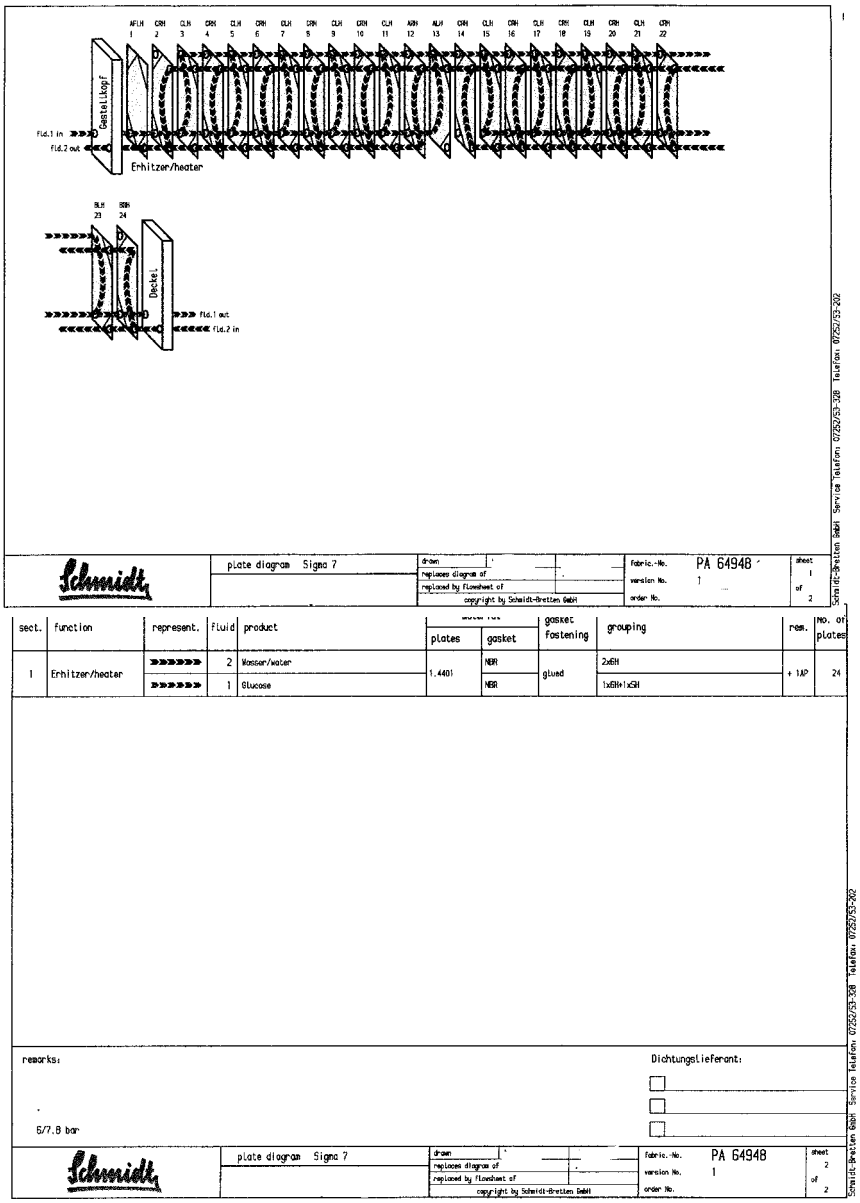
The laws and regulations of the country in which the plate heat exchanger is to operate apply to the start-up of the system.

6.8 Plate Diagram

The plate diagram is contained in a schematic drawing out of which the proper sequence of the heat exchange plates within the heat exchanger unit can be read.

The flow paths by which the medium is pumped through the heat exchange unit can be verified with the help of this drawing.

The identification of each individual plate can be seen in detail in a previous chapter. In this way, each plate can be identified on the basis of its perforations and its orientation.


Gestellkopf
Fld.1 in
Fld.2 out
Erhitzer/heater
Deckel
Fld.1 out
Fld.2 in
plate diagram Sigma 7
PA 64948
plate diagram Sigma 7
PA 64948
sect. | function | represent. | fluid | product | plates | gasket | gasket fastening | grouping | rem. | No. of plates
1 | Erhitzer/heater | 2 | Wasser/water | 1.4401 | NBR | glued | 2xBH | + 1AP | 24
1 | Glucose | NBR | 1xBH+1xSH
remarks:
5/7.8 bar
Dichtungslieferant:

7. Recognizing and Correcting Mistakes

During the operation of the heat exchanger unit it is possible that malfunctions occur. These malfunctions may be caused by outer influences or by the circumference of the heat exchanger unit.

Below you will find a list of questions you should try and answer before taking up contact with API Schmidt-Bretten so that we can help you more quickly. Included below you will also find registers which include possible malfunctions with their possible causes and solutions to these problems as well as suggestions how to avoid these problems.

7.1 List of Questions

- Is there a leakage problem?
- Where is the leakage (outer or inner leakage, on the plate pack, on the connections, between the plate pack and the frame) ?
- How strong is the leak (drops or continuous stream) ?
- When does the leakage occur (permanent, during operation, during on- or off-switching, during production or cleaning) ?
- Is the heat exchanger unit in continuous operation ?
- Do pressure variations or temperature variations occur ?
- How many plates are presently contained in the plate pack ?
- Is the unit functioning with the original number of heat exchanger plates ?
- What is the present platage ?
- How large is the theoretic final platage ?
- Is the heat exchanger unit clamped without inclination ?
- Are there any stresses between the pipelines connections to the frame, cover, or intermediate frames?
- Are the gaskets still in place (even pattern along the plate pack) ?
- How old are the plates and the gaskets ?
- What is the composition of the products and cleaning agents used in the unit ?
- Is there a problem with the heat capacity (flow rate or outlet temperature) ?
- How long has the unit been functioned without problems ?

7.2 Leakage Towards the Outside

Problem	Solutions	Possible causes	How to avoid these problems in the future
Corrosion of the plates	Replacement of the plates	Chlorides	Change the material of the heat exchanger plates
Deformation of the plates	Replacement of the plates	Pressure shocks Over-pressing of the plates	Change the valves or the production process. Teaching of the maintenance stuff
Plate cracks	Replacement of the plates	Pressure changes, Chemical attacks on the plate material	Thicker plate material and reduction of the platage. More resistant plate material
Aging of the gaskets	Replacement of the gaskets	End of lifetime, Temperature- or pressure-changes	Change the gasket material
Leakage when cold	Replacement of the gaskets	Aging of the gaskets, especially compressed fiber gaskets	Installation of spring packages on the tie rods
Hardening of the gaskets	Replacement of the gaskets	Inadequate chemical resistance, Temperatures too high	Change the gasket material
Swelling of the gaskets	Replacement of the gaskets	Inadequate chemical resistance, Temperatures too high	Change the gasket material
Gasket cracks	Replacement of the gaskets	Mechanical stress	Arrangements to avoid mechanical stress

7.3 Product Mixture / Internal Leakage

Problem	Solution	Possible cause	How to avoid these problems in the future
Corrosion of the plates	Exchange of the plates	Chlorides	Change the material of the heat exchanger plates
Plate cracks	Exchange of the plates	Pressure changes, Chemical attacks on the plate material	Thicker plate material, Reduction of platage. More resistant plate material
Braking of the connections	Exchange of the connections	Stresses in the pipeline	Compensatory expansion joints or articulation elbows

7.4 Heat Exchange Performance Problems / Low Service Life

Problem	Solution	Possible cause	How to avoid these problems in the future
Fouling in the plate gaps	Cleaning of the plate heat exchanger	Particles, Fibers, Bacteria Composition of the product Hard deposit due to high temperature	Filters Changing of the plate arrangement Changing of the temperature difference between cold and hot side
Fouling in the connections	Cleaning of the plate heat exchanger	Particles, Fibers, Bacteria Composition of the product	Filters
Changing of the operating conditions	Switch back to old operating conditions, if possible	Entrance temperatures Change of flow rates Composition of the product	Changing of the plate arrangement or plate type

7.5 Pressure Loss- / Flow Rate Problems

Problem	Solution	Possible cause	How to avoid these problems in the future
Fouling in the plate gaps	Cleaning of the PHE	Particles, Fibers, Bacteria Consistency of the product Hard deposit due to high temperature	Filter Changing of the plate arrangement Changing of the temperature difference between cold and hot side
Fouling in the connections	Cleaning of the PHE	Particles, Fibers, Bacteria Composition of the product	Filter
Changes of operating conditions	Switch back to old operating conditions, if possible	Entrance temperatures Flow rates Composition of the product	Changing of the plate arrangement or plate type

8. Spare Parts

It is recommended to keep spare parts in stock at the production site, as far as the plate heat exchanger is a necessary and urgent component of your production process.

Depending on the possible off-time the following variants of spare parts vary:

- Spare gaskets
- Single spare plates
- Complete gasketed plate package
- A complete stand-by PHE

Normally it is no necessary to keep spare parts for the frames or intermediate frames in stock at the facility.

Keep the following conditions for the storage of the above mentioned spare parts:

- Gaskets and gasketed plates should not be stored for more than two years
- Don’t store the parts outside
- Storage is good at temperatures below room temperature
- If possible store the parts in a dark room and avoid neon light
- The atmosphere in the store has to be free of solvents or ozone

9. Tools

For best handling for mounting or maintenance work with the plate heat exchanger, several tools should be available.

- Spanner for smaller units
- Wretch-spanner for larger units
- Electric or hydraulic screwing machine for very large units
- Lifting gears as fork lifter or a crane should be on site, if frame parts have to be changed

10. Documentation

The standard documentation contains the following papers and pieces:

- Name Plate
- Dimensioned drawing of the unit
- Parts List
- Plate Diagram
- Technical Datasheet
- Operating Manual

Optional the documentation can be supplemented by:

- Manufacturer Certificate
- Declaration of conformity (where appropriate)
- Material certificate
- Approval drawings
- Documentation of inspection by an inspection company (for example TÜV, GL)

API Schmidt-Bretten

11. Addresses

Feel free to contact our stuff in the main facility in Bretten or in one of the subsidiaries outside Germany, if you have any question or need any information about spare parts or other products of **API Schmidt-Bretten**.

API Schmidt-Bretten GmbH & Co. KG
Pforzheimer Strasse 46
D-75015 Bretten
Germany
Phone +49 / (0)7252 / 53 - 0
Fax +49 / (0)7272 / 53 - 200

API Schmidt-Bretten Inc.
2777 Walden Avenue
Buffalo, New York 14225
USA
Phone +1 / 716 / 68 - 46 700
Fax. +1 / 716 / 68 - 11 125

Schmidt-Bretten Ned. B.V.
Apolloweg 7 D/E
NL-8938 AT Leeuwarden
The Netherlands
Phone +35 / 58 / 288 55 80
Fax. +35 / 58 / 288 50 05

S.A.R.L. Schmidt-Bretten France
Z.A.C. de la Coix Prunelle
F-27220 Saint André-de l'Eure
France
Phone +33 / (0) 232 60 26 80
Fax. +33 / (0) 232 60 28 77

Schmidt-Bretten Espana S.L.
Avda. de la Fama 66-72
E-08940 Cornella de Llobregat
Spain
Phone +34 / 93 377 31 92
Fax. +34 / 93 377 32 93

Schmidt-Bretten Romania S.R.L.
Sos. Vergului, Nr. 59, Sect. 2
Bucaresti
Romania
Phone +40 / 1 / 255 21 95
Fax. +40 / 1 / 255 33 36

Schmidt-Bretten India Pct. Ltd.
124/3, Vitthalwadi Road
411 030 Pune
India
Phone +91 / 20 / 433 86 42
Fax. +91 / 20 / 433 79 13

Important Note !!!!

The plate heat exchanger is only allowed to operate under the specified operating conditions otherwise the guarantee and all other liabilities of the manufacturer will expire !

API Schmidt-Bretten GmbH & Co. KG

Pforzheimer Strasse 46, D-75015 Bretten, Germany

Phone +49 7252 53-0, Fax +49 7252 53200, Email: info@apischmidt-bretten.de